Green Jobs Green New York

Energy Study

Prepared for:
Millbrook Library

3 Friendly Lane

Millbrook, NY, 12545

Audit No: G563-NSD

Submitted by:
L&S Energy Services
58 Clifton Country Road, Suite 203
Clifton Park, NY 12065

Date: 6/8/2021

For questions regarding this report, please contact FlexTech@nyserda.ny.gov.

We hope the findings of this report will assist you in making decisions about energy efficiency improvements in your facility. Thank you for your participation in this program.

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State of New York

Andrew Cuomo, Governor

New York State Energy Research and Development Authority

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This report was prepared by:

Daylight Savings

25 Main Street, Goshen, NY, 10924

(800) 337-2192

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Executive Summary

This study was performed to understand how your facility is currently using energy and identify ways to reduce energy use and operating expenses.

The owner was interested in general energy saving opportunities.

The following energy efficiency measures (EEMs) and observations to reduce energy use were identified during the site visit:

- The major opportunity to reduce energy use and cost is to improve the interior lighting efficiency through LED light sources. Seek out proposals from electrical contractors that specialize in lighting retrofit work and familiarize yourself with your electric utility's incentive programs and financing options.
- Currently there appears to be minimal setbacks on the programmable thermostats. Proper temperature control is important in order to minimize energy costs. It is recommended to be more aggressive with the setbacks with a setpoint of 55F during the winter unoccupied times.
- Replacing the existing upright fridge with a new energy star rated unit was deemed not cost effective.

These Energy Efficiency Measures are summarized in the Project Summary Table below and discussed in more detail in the Energy Efficiency Measures section of this report.

Clean Heating and Cooling Screening

NYSERDA has developed a screening tool to evaluate buildings for conversion from fossil fuel based heating and cooling systems to electric systems using various heat pump technologies. We performed a Clean Heating and Cooling (CHC) screening for your facility to evaluate the impact of replacing your current heating and cooling systems with a ground source heat pump system or a Variable Refrigerant Flow (VRF) air source heat pump system. The results of this screening are presented in a separate report that is a companion to this Green Jobs Green New York report.

Please see the companion Clean Heating and Cooling Screening report for details.

Present Energy Use and Cost

The energy use for your facility has been compiled to calculate the Energy Cost Index and the Energy Use Intensity.

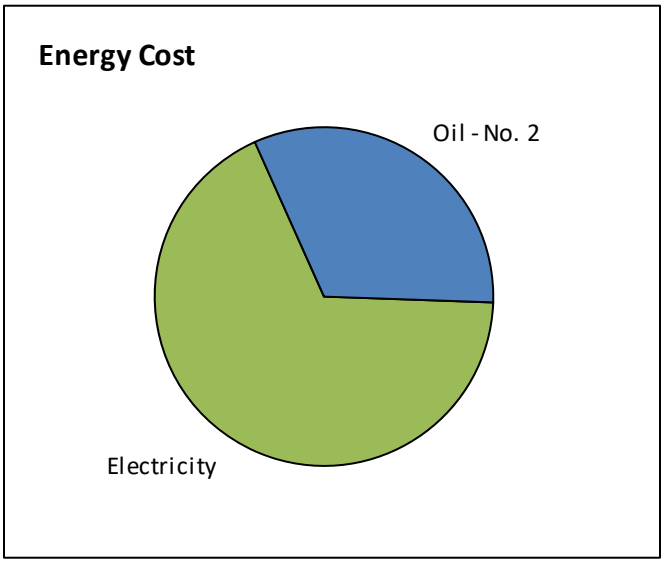
- The Energy Cost Index (ECI) is the total cost of energy divided by the conditioned floor area and is shown as dollars per square foot per year.
- The Energy Use Intensity (EUI) is the total heat content of energy divided by the conditioned floor area and is shown in units of one thousand Btus (kBtu) per square foot per year.

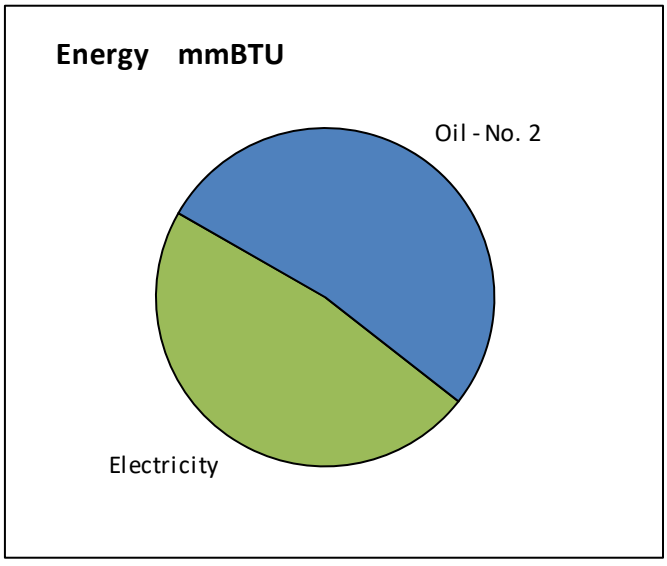
Energy Cost Index

Electricity	$ 11,162	$ 0.74	$/sq.ft./year
Oil - No. 2	$ 5,315	$ 0.35	$/sq.ft./year
Total Cost	$ 16,477	$ 1.10	$/sq.ft./year

Energy Use Intensity

Electricity	307	mmBtu	20.5	kBtu/sq.ft./year
Oil - No. 2	337	mmBtu	22.4	kBtu/sq.ft./year
Total Energy Use	644	mmBtu	42.9	kBtu/sq.ft./year





Energy Cost Index $ 1.10 /sf/yr. **Energy Use Intensity 42.9 kBTU/sf/yr.**

Benchmarking Your Building

The EPA's ENERGY STAR Portfolio Manager website allows you to upload energy use information and compare your energy use to that of other buildings of similar use. Portfolio Manager generates a benchmark score that indicates your performance. A benchmark score of 50 indicates average performance while a score of 75 or higher would earn the Energy Star designation. You can use the website to track your energy use over time and document the success of your energy conservation efforts.

You can find the Portfolio Manager at:

https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager

Project Summary Table

Energy Efficiency Measures				Electric Savings			Fuel Savings			$ Savings & Cost		
EEM #	Measure Status	EEM Category	EEM Description	kWh	kW	Electric Cost Savings	Fuel Type	Fuel MMBtu Savings	Fuel Cost Savings	Total Annual Savings	Install Costs	Simple Payback (years)
EEM-1	R	Lighting	Interior Lighting Retrofit	25,325	8.4	$ 2,429	Oil - No. 2	(58)	($ 919)	$ 1,510	$ 10,183	6.7
EEM-2	R	Lighting	Exterior Lighting Retrofit	4,907	0.0	$ 236		0	$ 0	$ 236	$ 1,896	8.1
EEM-3	R	Controls	Improve Temperature Control	427	0.0	$ 20	Oil - No. 2	61	$ 967	$ 988	$ 600	0.6
EEM-4	RNE	Refrigeration	Replace Old Refrigerators	262	0.0	$ 13		0	$ 0	$ 13	$ 600	47.8
CHC-1		HVAC	Install Ground Source Heat Pump System	See the Clean Heating and Cooling Report for the results of this analysis								
CHC-2		HVAC	Install Air Source Heat Pump System	See the Clean Heating and Cooling Report for the results of this analysis								
CHC-3		HVAC	Install Variable Refrigerant Flow (VRF) HVAC System	See the Clean Heating and Cooling Report for the results of this analysis								
			Total of Recommended Measures:	30,921	8.4	$ 2,697		3	$ 48	$ 2,745	$ 13,279	4.8

Measure Status: Implemented (I): Measure has been installed; Recommended (R): Energy saved with a reasonable payback (within measure life)
Not Recommended (NR): When payback exceeds measure life and equipment is not at end of life
Recommended Mutually Exclusive (RME): Energy is saved and recommended over other options for a particular measure
Mutually Exclusive (ME): Non-recommended option(s) to a Recommended Mutually Exclusive (RME) measure;
Recommended Non-Energy (RNE): Recommended but no electricity or fuel savings (ex. comfort only, water savings only) or recommended when the equipment is at the end of useful life and where the simple payback is reasonable
Recommended for Further Study (RS): For measures that require analysis beyond the scope of this program.

Simple Payback Period is the length of time it will take to recover the initial capital investment from the energy savings of the new equipment. The Simple Payback Period is calculated by dividing the initial installed cost by the annual energy cost savings. For example, an energy-saving measure that costs $5,000 and saves $2,500 per year has a Simple Payback Period of $5,000 divided by $2,500 or 2 years.

Greenhouse Gas Reductions for the Recommended Measures

Reducing your energy use will reduce the release of greenhouse gases associated with the use of fossil fuels and the production of electricity. If the measures recommended in this report are implemented, the following reductions of greenhouse gases can be expected:

Electricity	30,921	kWh =	35,868	pounds CO2 equivalent
Oil - No. 2	22	gal. =	495	pounds CO2 equivalent
			36,363	pounds CO2 equivalent
			22.8%	reduction

Emissions factors are used to translate the energy savings data from energy efficiency and renewable generation projects into annual GHG emissions reduction values. NYSERDA uses emission factors derived from U.S. Environmental Protection Agency (EPA) emission coefficients to calculate emissions from onsite fuel. The CO2e values represent aggregate CO2, CH4, and N2O emissions.

Assistance for Implementation of Recommendations

This study provides recommendations on specific actions to take to increase energy efficiency; the next step is implementing the recommendation(s). Complimentary assistance with implementing energy efficiency recommendations is available through NYSERDA's Regional Community Energy Advisors (CEAs).

The Regional CEA can assist with identifying utility company incentives and various financing options available for energy efficiency improvements, such as GJGNY Loans, or Commercial Property Assessed Clean Energy (CPACE) on-bill Financing.

Your Community Energy Advisor is:

Cornell Cooperative Extension Dutchess County

Collin Adkins

cda37@cornell.edu

(845) 677-8223 x113

COVID-19

NYSERDA encourages study participants to review COVID-related building operation guidelines published by New York State, ASHRAE and other trusted sources, as applicable. Links to these resources are included below along with a link to the FlexTech Program Indoor Air Quality (IAQ) effort, which is focused on the evaluation of filtration, ventilation, and building operation optimization measures as well as Ultraviolet Germicidal Irradiation (UVGI) in response to the COVID-19 crisis.

- New York State: https://forward.ny.gov/
- ASHRAE: https://www.ashrae.org/technical-resources/resources
- FlexTech Program IAQ Effort: https://www.nyserda.ny.gov/All-Programs/Programs/FlexTech Program/Indoor-Air-Quality

Energy Efficiency Measure Descriptions

EEM-1 Interior Lighting Retrofit

Electric Savings:	$ 2,429	25,325	kWh per year
		8.4	kW demand
Fuel Savings:	($ 919)	(58.2)	MMBtu fuel per year
			Oil - No. 2
Total Annual Savings:	**$ 1,510**		
Project Cost:	**$ 10,183**		
Simple Payback:	**6.7**	**years**	

Introduction:

Lighting usually represents a major portion of a facility's electricity use, and given the continuous hours of use, it contributes to the peak electric demand each month. Taking steps to improve the efficiency of your lighting will reduce both the total electric energy used and lower your peak electric demand. Lighting retrofit projects now consist of installing Light Emitting Diode, or LED, light sources in all fixtures. Some fixtures, such as indoor fluorescent fixtures, can be retrofitted to use T-8 replacement lamps, but most fixtures should simply be replaced with LED fixtures. Energy savings of 50% are common when replacing fluorescent and HID light sources with LED sources.

LED light sources for interior applications should list their color on the label; this is expressed in degrees Kelvin, or °K. Lights with higher values will be more blue in color and may not be appropriate for indoor use. Look for values between 3500 and 4000°K for "cool white" light. For spaces where a warmer color of light is desired, select lights with values between 2700 and 3000°K.

Recommendation:

Retrofit interior fluorescent fixtures and replace other fixtures as indicated in the lighting calculations and the Equipment Inventory, both of which may be found in the Appendix.

LED lamps and fixtures should be Energy Star labeled or listed with the Design Lights Consortium (DLC). Your utility incentive program may have other requirements that must be met in order to qualify for incentives.

EEM-2 Exterior Lighting Retrofit

Electric Savings:	$ 236	4,907	kWh per year
		0.0	kW demand
Fuel Savings:	$ 0	0.0	MMBtu fuel per year
Total Annual Savings:	**$ 236**		
Project Cost:	**$ 1,896**		
Simple Payback:	**8.1**	**years**	

Introduction:

High Intensity Discharge (HID) fixtures are often used outdoors for parking areas, grounds illumination and outdoor security lighting. HID fixtures may use mercury vapor, high pressure sodium or metal halide lamps that resemble incandescent lamps in outward appearance but require a ballast to operate. Of these, high pressure sodium and metal halide are the most common. All HID lamp types are point light sources, so HID fixtures usually have a reflector to redirect light into the desired distribution pattern. HID fixtures do not provide very uniform lighting in exterior applications.

Light Emitting Diode (LED) fixtures use an array of LEDs, which are solid state devices that produce light. The array is designed to distribute light into the desired distribution pattern, utilizing the directional nature of LEDs to achieve very uniform light levels without "hot spots" that are common with HID fixtures. This enables LED fixtures to provide the required illumination levels with lower overall energy use than traditional HID fixtures. LED exterior fixtures have replaced HID fixtures in the marketplace because they are more efficient, more compact, and they last longer.

Recommendation:

Replace selected exterior fixtures as indicated in the lighting calculations and the Equipment Inventory, both of which may be found in the Appendix.

LED fixtures should be Energy Star labeled or listed with the Design Lights Consortium (DLC). Your utility incentive program may have other requirements that must be met in order to qualify for incentives.

EEM-3 Improve Temperature Control

Electric Savings:	$ 20	427	kWh per year
		0.0	kW demand
Fuel Savings:	$ 967	61.3	MMBtu fuel per year
			Oil - No. 2
Total Annual Savings:	**$ 988**		
Project Cost:	**$ 600**		
Simple Payback:	**0.6**	**years**	

Introduction:

Proper temperature control is important in order to minimize energy costs. Maintaining space temperatures within a reasonable range during occupied periods and reliably reducing the amount of heating and cooling energy during unoccupied periods should be the goal for your temperature control system.

Facilities that are occupied only on weekdays can maintain a lower space temperature setpoint on weekends. Programmable thermostats are available that permit full 7 day schedules to be defined. 5-2 or 5-1-1 thermostats use the same schedule for all weekdays and provide one or two schedules for weekdays.

Recommendation:

Reprogram the thermostats to a setback temperature of 55 degrees for heating and 88 degrees for cooling.

EEM-4 Replace Old Refrigerators

Electric Savings:	$ 13	262	kWh per year
		0.0	kW demand
Fuel Savings:	$ 0	0.0	MMBtu fuel per year
Total Annual Savings:	**$ 13**		
Project Cost:	**$ 600**		
Simple Payback:	**47.8**	**years**	

Introduction:

Energy Star qualified refrigerators are 10 percent more efficient than models that simply meet the federal minimum standard for energy efficiency. Refrigerators manufactured prior to 1993 can be expected to use twice as much energy as current Energy Star labeled refrigerators.

The Energy Star website has a list of all refrigerator models that meet current Energy Star requirements at http://www.energystar.gov/certified-products/detail/refrigerators"

Visit the Energy Star website to find a list of all refrigerator models that meet current Energy Star requirements.

Recommendation:

When needed, replace the refrigerator(s) listed below with an Energy Star Labeled refrigerator.

Qty	cu.ft.	Type
1	15	Refrigerator w/ top freezer

Discarded refrigerators should be safely recycled. The law requires that the R12 or R134A refrigerant gas in the old refrigerator must be carefully removed and properly disposed of to avoid environmental pollution."

Existing Conditions

The site is a library.

The building consists of 15,000 square feet on 1 floor; it was built in approximately 1900. The exterior walls have a brick structure with an exterior finish of brick and foam insulation. The hip roof has an asphalt shingle exterior surface, fiberglass insulation and an interior finished ceiling of plaster.

The windows are double glazed double hung aluminum sash. The exterior doors are aluminum with full double glazing, with full weather stripping.

Insulation was deemed sufficient and windows are in good condition. Lights are predominantly incandescent and fluorescents with adequate controls.

Major energy end uses include heating, cooling and lighting."

The facility is occupied 7 days per week for a total of 68 hours per week. The HVAC system maintains occupied conditions for 68 hours per week.

Winter space temperatures are normally maintained at 73 and are setback to 60°F during unoccupied periods. Temperature control is provided by programmable thermostats. In the summer, temperatures are maintained at 72°F during occupied hours and 72°F during unoccupied periods.

See Appendix D for further details regarding the energy calculations performed for this study.

Appendix A

Equipment Inventory

Heating and Air Conditioning Equipment									
Unit Type	**Qty**	**Make/Model**	**Heating kBtuh**	**Heating Eff.**	**Cooling Capacity**	**Units**	**EER**	**Serves/Location**	**Year**
Boiler	1	Burnham/V904A	483	80%	-	kbtuh	-	Entire Building/Basement	2010
Condensing Unit #1	1	Lennox/LSA072C-1Y	-	-	7 1/2	tons	12.5	Rooftop	2012
Condensing Unit #2	1	Lennox/HS29-072-1Y	-	-	7 1/2	tons	12.5	Rooftop	2012
Condensing Unit #3	1	Carrier/38ARS012	-	-	15	tons	12.5	Rooftop	2012
Condensing Unit #4	1	Lennox/HS29	-	-	15	tons	12.5	Rooftop	2012
Condensing Unit #5	1	Lennox/HS29-090-2Y	-	-	12 1/2	tons	12.5	Rooftop	2012

Domestic Hot Water									
Unit Type	**Qty**	**Make/Model**	**Capacity**	**Units**	**Fuel Type**	**Storage Capacity (gal.)**	**Eff.**	**Serves/Location**	**Year**
Storage	1	Ao Smith/DSE30-6	6	KW	Electricity	30	90%	Mech Room	2012

Motors									
Unit Type	**Qty**	**Make/Model**	**HP**	**Loading**	**Type**	**Hours/year**	**Eff.**	**Serves/Location**	**Year**
AHU's	5	McQuay/CAH006FDAC	2	80%	std	3,380	81%	Entire Building/Attic	2011
Condensing Unit #1	1	Lennox/LSA072C-1Y	1/2	80%	std	1,430	68%	Entire Building/Rooftop	2012
Condensing Unit #2	1	Lennox/HS29-072-1Y	1/2	80%	std	1,430	68%	Entire Building/Rooftop	2012
Condensing Unit #3	2	Carrier/38ARS012	1/2	80%	std	1,430	68%	Entire Building/Rooftop	2012
Condensing Unit #4	1	Lennox/HS29	1/2	80%	std	1,430	68%	Entire Building/Rooftop	2012
Condensing Unit #5	1	Lennox/HS29-090-2Y	1/2	80%	std	1,430	68%	Entire Building/Rooftop	2012

Interior Lighting Fixtures											
Existing Fixtures						Recommended	Recommended Interior Lighting Efficiency Improvements				
Line #	Area	Qty	Present Lighting Type	Lamps /fixt	Watts /Fixt	Control Type	Measure Type	Qty	Proposed Lighting Type	Lamps /fixt	Watts /Fixt
1	Mechroom Basem	8	4' 32w T8 Elec. bal.	2	59	No Change	Linear LED	8	4' LED T8 2200 lu. 17W	2	34
2	1908 Basement	10	4' 32w T8 Elec. bal.	2	59	No Change	Linear LED	10	4' LED T8 2200 lu. 17W	2	34
3	Staff Room	3	36w CFL Biax Elec. bal.	2	72	No Change	New LED Fixture	3	2x2 LED, 30W	2	60
4	Staff Room	3	26w CFL Triple Elec. bal.	2	50	No Change	LED Relamp	3	A19 LED, 9W	2	18
5	Storage Closet	2	36w CFL Biax Elec. bal.	2	72	No Change	New LED Fixture	2	2x2 LED, 30W	2	60
6	Children Library	34	4' 32w T8 Elec. bal.	3	89	No Change	Linear LED	34	4' LED T8 2200 lu. 17W	3	51
7	Children Library	5	26w CFL Triple Elec. bal.	2	50	No Change	LED Relamp	5	A19 LED, 9W	2	18
8	2002 Basement	1	U 40w T12 Elec. bal.	1	40	No Change	LED Relamp	1	T8 U-Bend LED, 18W	1	18
9	2002 Basement	1	U 32w T8 Elec. bal.	1	31	No Change	LED Relamp	1	T8 U-Bend LED, 18W	1	18
10	2002 Basement	1	U 32w T8 Elec. bal.	2	59	No Change	LED Relamp	1	T8 U-Bend LED, 18W	2	36
11	2002 Basement	3	4' 32w T8 Elec. bal.	2	59	No Change	New LED Fixture	3	4' LED T8 2200 lu. 17W	2	34
12	Hallway	22	26w CFL Triple Elec. bal.	2	50	No Change	LED Relamp	22	A19 LED, 9W	2	18
13	Hallway	2	4' 32w T8 Elec. bal.	2	59	No Change	Linear LED	2	4' LED T8 2200 lu. 17W	2	34
14	Community Room	12	36w CFL Biax Elec. bal.	2	72	No Change	New LED Fixture	12	2x2 LED, 30W	2	60
15	Bathrooms	2	36w CFL Biax Elec. bal.	3	108	No Change	New LED Fixture	2	2x2 LED, 30W	3	90
16	2002 Addition Ups	21	26w CFL Triple Elec. bal.	2	50	No Change	LED Relamp	21	A19 LED, 9W	2	18
17	2002 Addition Ups	44	4' 32w T8 Elec. bal.	2	59	No Change	Linear LED	44	4' LED T8 2200 lu. 17W	2	34
18	2002 Addition Ups	2	36w CFL Biax Elec. bal.	2	72	No Change	New LED Fixture	2	2x2 LED, 30W	2	60
19	1970 Addition	20	26w CFL Triple Elec. bal.	2	50	No Change	LED Relamp	20	A19 LED, 9W	2	18
20	1970 Addition	3	36w CFL Biax Elec. bal.	2	72	No Change	New LED Fixture	3	2x2 LED, 30W	2	60
21	1970 Addition	8	4' 32w T8 Elec. bal.	2	59	No Change	Linear LED	8	4' LED T8 2200 lu. 17W	2	34
22	1970 Addition	1	53 watt Incandescent	1	53	No Change	LED Relamp	1	A19 LED, 9W	1	9
23	1970 Addition	12	26w CFL Triple Elec. bal.	2	50	No Change	LED Relamp	12	A19 LED, 9W	2	18
24	1970 Addition	1	36w CFL Biax Elec. bal.	2	72	No Change	New LED Fixture	1	2x2 LED, 30W	2	60
25	Office	4	36w CFL Biax Elec. bal.	2	72	No Change	New LED Fixture	4	2x2 LED, 30W	2	60
26	Office	5	26w CFL Triple Elec. bal.	2	50	No Change	LED Relamp	5	A19 LED, 9W	2	18
27	Bath	2	36w CFL Biax Elec. bal.	2	72	No Change	New LED Fixture	2	2x2 LED, 30W	2	60
28	Flagger Room	6	36w CFL Biax Elec. bal.	2	72	No Change	New LED Fixture	6	2x2 LED, 30W	2	60
29	Flagger Room	15	26w CFL Triple Elec. bal.	2	50	No Change	LED Relamp	15	A19 LED, 9W	2	18

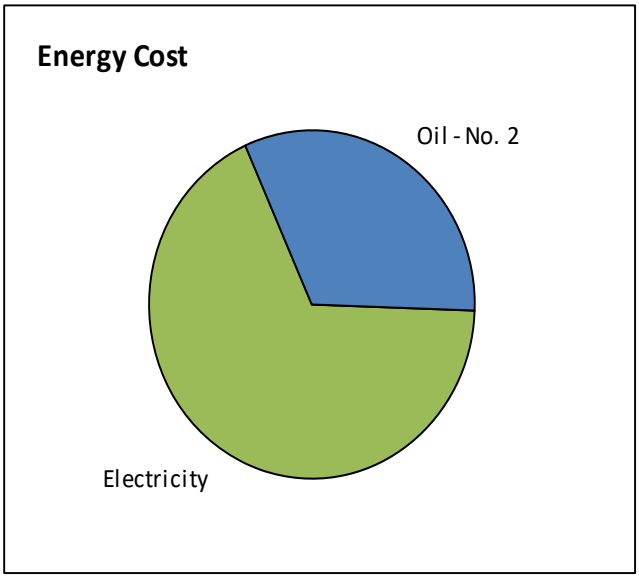
Exterior Lighting Fixtures											
Existing Fixtures						Recommended	Lighting Efficiency Improvements				
Line #	Area	Qty	Present Lighting Type	Lamps /fixt	Watts /Fixt	Control Type	Measure Type	Qty	Proposed Lighting Type	Lamps /fixt	Watts /Fixt
1	Outside	9	150w HPS	1	188	No Change	LED Area Light	9	LED area light, 75W	1	75
2	Outside	2	23w CFL Elec. bal.	1	25	No Change	LED Relamp	2	A19 LED, 9W	1	9
3	Outside	11	A19 LED, 9W	1	9	No Change	No change	11	A19 LED, 9W	1	9
4	Outside	1	LED area light, 75W	1	75	No Change	No change	1	LED area light, 75W	1	75

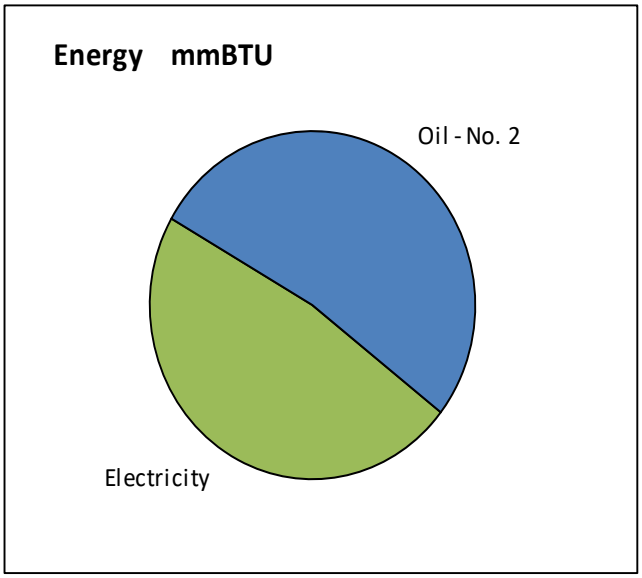
Appendix B

Energy Use and Cost Summary

Energy		Units Used		BTU/unit	mmBTU	% of total	kBtu/sq.ft./year
	Electricity	90,103	kwh	3,412	307	48%	20.5
	Oil - No. 2	2,440	gal.	138,000	337	52%	22.4
	Total				644		42.9

Cost		Energy Cost	Unit Costs		% of total	$/sq.ft./year
	Electricity	$ 11,162	$ 0.048	kwh	68%	$ 0.74
	Oil - No. 2	$ 5,315	$ 2.178	gal.	32%	$ 0.35
	Total	$ 16,477				$ 1.10





Energy Cost Index $ 1.10 /sf/yr. **Energy Use Intensity 42.9 kBTU/sf/yr.**

Utility Bill Data

The following pages present the energy use and cost data for your facility and establish the value of each type of energy. Electricity is measured and billed in units of kilowatt-hours (kWh) that represent the total amount of electricity used in the billing period. Electricity may also be billed based on the highest rate of use, or peak demand, that occurred during the billing period. Electric demand is billed in units of kilowatts (kW).

Other fuels may be billed in volume units (gallons, hundred cubic feet or ccf, etc.) or based on their heat content (therms, equal to 100,000 British Thermal Units). All energy types may be converted into a common unit, such as BTUs, to facilitate analysis and comparison with other facilities. One million BTUs is abbreviated as mmBtu in this report.

ELECTRICITY CONSUMPTION AND COST ANALYSIS

Millbrook Library

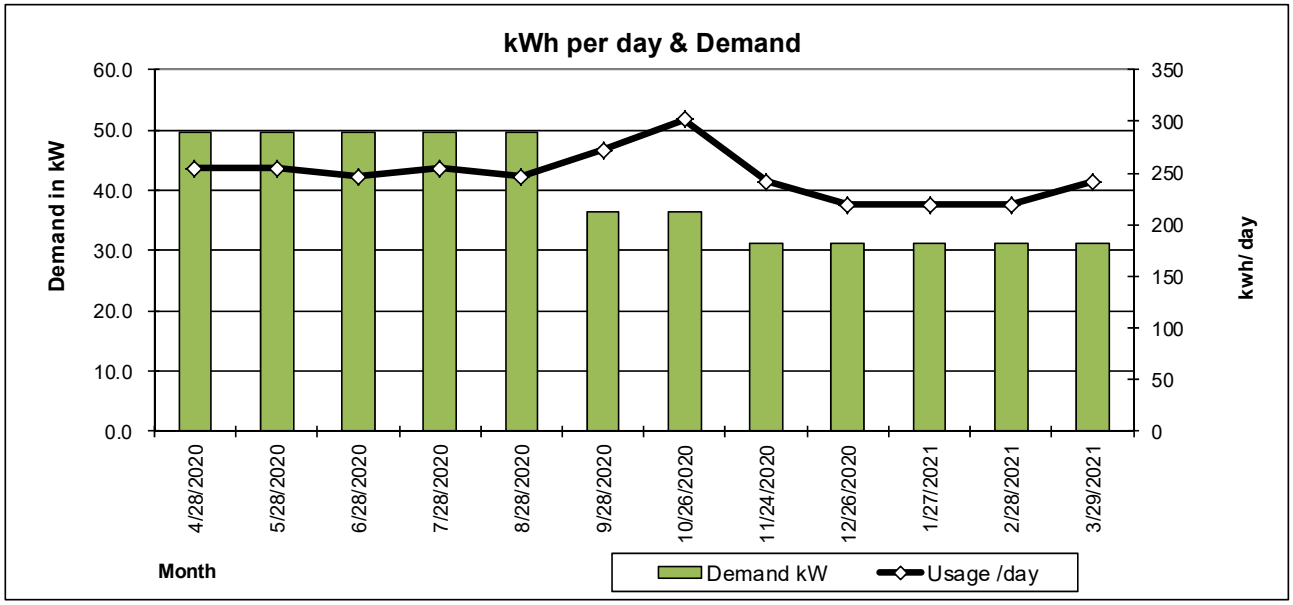
Gross Area: 15,000 s.f.
20,495 Btu/s.f./Yr
$ 0.74 /s.f.
3.3 watts/s.f.

Utility: CHG&E
Account # ends w/ 01-9
Rate: SC E201 General Service
Meter Charge: $ 92.50 / month
Demand Charge: $ 12.00 / kW
Supplier: CHG&E

Month Ending	Days	Usage Energy kWh	Usage Demand kW	Electricity Charges Utility Cost	Electricity Charges Supply Costs	Total Electricity Cost	Demand Cost	Energy $/kWh	Load Factor	Usage /day
4/28/2020	30	7,629	49.6	$ 428	$ 653	$ 1,080	$ 595	$ 0.051	0.21	254
5/28/2020	30	7,629	49.6	$ 428	$ 653	$ 1,080	$ 595	$ 0.051	0.21	254
6/28/2020	31	7,629	49.6	$ 428	$ 653	$ 1,080	$ 595	$ 0.051	0.21	246
7/28/2020	30	7,629	49.6	$ 428	$ 653	$ 1,080	$ 595	$ 0.051	0.21	254
8/28/2020	31	7,629	49.6	$ 428	$ 653	$ 1,080	$ 595	$ 0.051	0.21	246
9/28/2020	31	8,440	36.4	$ 473	$ 469	$ 943	$ 437	$ 0.049	0.31	272
10/26/2020	28	8,440	36.4	$ 473	$ 469	$ 943	$ 437	$ 0.049	0.35	301
11/24/2020	29	7,016	31.2	$ 393	$ 381	$ 775	$ 374	$ 0.044	0.32	242
12/26/2020	32	7,016	31.2	$ 393	$ 381	$ 775	$ 374	$ 0.044	0.29	219
1/27/2021	32	7,016	31.2	$ 393	$ 381	$ 775	$ 374	$ 0.044	0.29	219
2/28/2021	32	7,016	31.2	$ 393	$ 381	$ 775	$ 374	$ 0.044	0.29	219
3/29/2021	29	7,016	31.2	$ 393	$ 381	$ 775	$ 374	$ 0.044	0.32	242
	365	**90,103**	**476.8**	**$ 5,052**	**$ 6,110**	**$ 11,162**	**$ 5,722**	**$ 0.048**	**0.26**	**247**

Annual Energy: **90,103** **kWh / year** **$ 11,162** **/year**
Peak Demand: **50** **kW Peak**
Average Demand: **40** **kW**

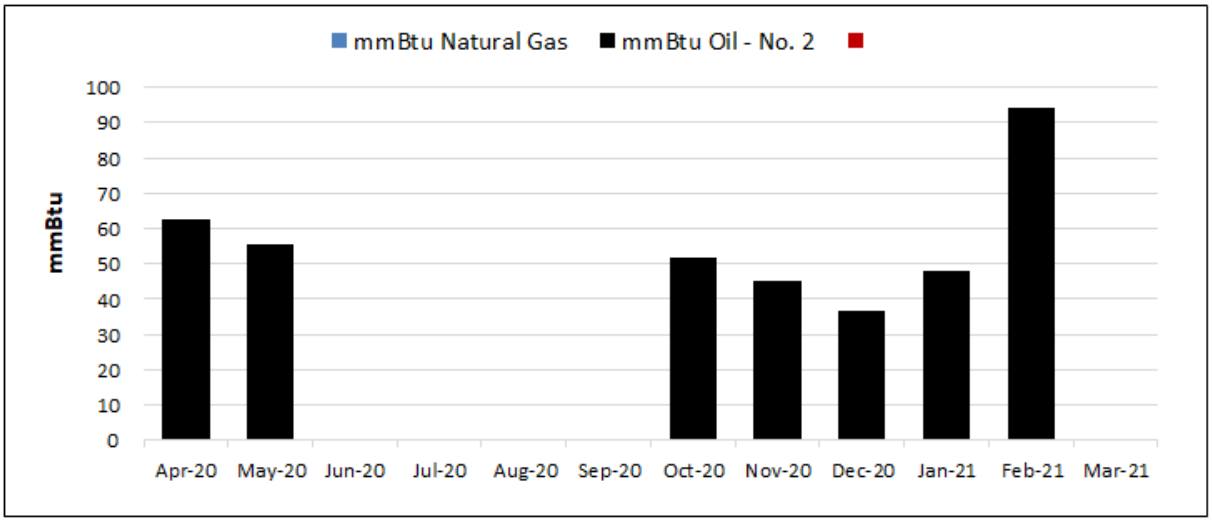
Unit Costs
Demand **$ 12.00** **$/kW**
Energy **$ 0.048** **$/kWh Incremental**
Blended **$ 0.124** **$/kWh Blended**

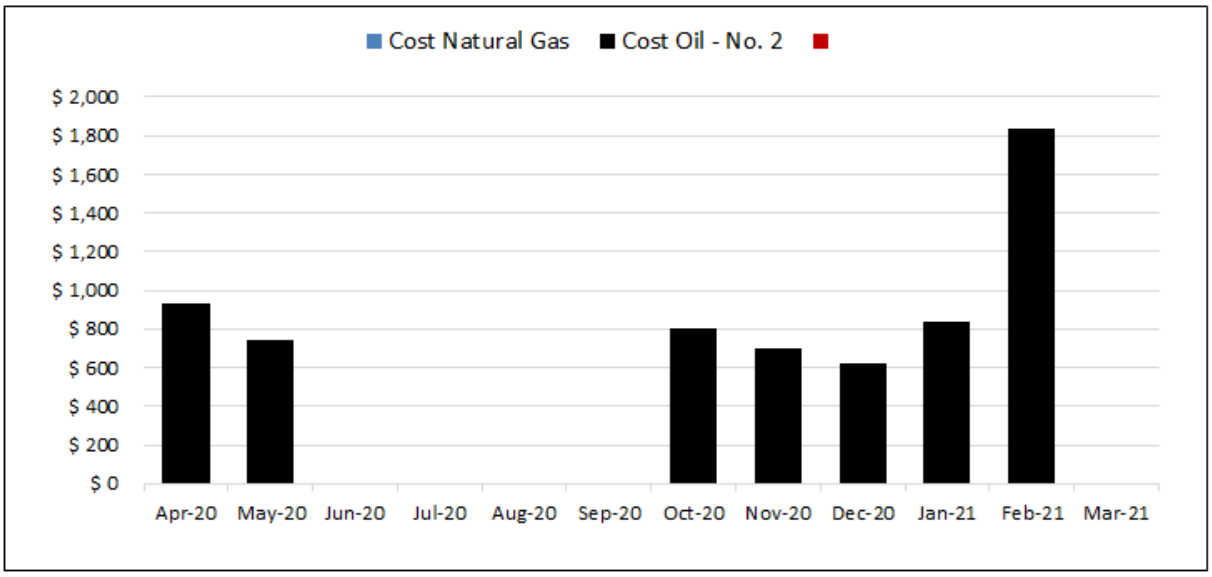


Note:
Billing periods are grouped by multiple months. The bills were divided out into their respective months.

ALL FUELS CONSUMPTION AND COST ANALYSIS **Millbrook Library**

Month	mmBtu Natural Gas	mmBtu Oil - No. 2		All Fuel mmBtu	Cost Natural Gas	Cost Oil - No. 2		All Fuel Cost
Apr-20	0	63	0	63	$0	$933	$0	$933
May-20	0	56	0	56	$0	$739	$0	$739
Jun-20	0	0	0	0	$0	$0	$0	$0
Jul-20	0	0	0	0	$0	$0	$0	$0
Aug-20	0	0	0	0	$0	$0	$0	$0
Sep-20	0	0	0	0	$0	$0	$0	$0
Oct-20	0	52	0	52	$0	$799	$0	$799
Nov-20	0	45	0	45	$0	$702	$0	$702
Dec-20	0	36	0	36	$0	$619	$0	$619
Jan-21	0	48	0	48	$0	$841	$0	$841
Feb-21	0	94	0	94	$0	$1,832	$0	$1,832
Mar-21	0	0	0	0	$0	$0	$0	$0
Total	0	394	0	394	$0	$6,465	$0	$6,465
$/mmBtu		$16.42		$16.42				
BTU/unit	100,000	138,000	92,000			1 mmBtu =	1,000,000	Btus
kBtu/SF/Yr.	0.0	26.3	0.0	26.3		1 kBtu =	1,000	Btus





Appendix C

EEM Calculations

Interactions

The Energy Efficiency Measure calculations in this section are stand-alone measures that are not interacted with the other calculations. Each measure shows the energy savings that may be expected if it is the only measure to be implemented. If multiple measures will be implemented, energy savings will likely be lower than the calculations represent.

As an example, replacing an 80% efficient boiler with a 92% efficient boiler will reduce the amount of fuel required to heat the building. If the walls and roof are insulated such that the required heating energy is reduced by 30%, the new boiler will serve a smaller heating load, and the energy savings gained from the boiler replacement will be reduced by 30%.

CALCULATIONS FOR INTERIOR LIGHTING RETROFIT

EEM-1 **Millbrook Library**

Type:	Units:	Unit cost:	BTU/unit	
Oil - No. 2	gal.	$ 2.178	138,000	
Electricity	kwh	$ 0.048	3,412	
Demand	kW	$ 12.00	12	Months of demand savings/year

100% of building is air conditioned

HVAC Adjustment Factors		
Cooling	Demand	Fuel
HVACc	HVACd	HVACg
11.40%	20.00%	-2.30%

	Existing Interior Lighting Systems					**Recommended Lighting Controls**					**Recommended Interior Lighting Efficiency Improvements**								
Line #	Area	Qty	Present Lighting Type	Lamps /fixt	Watts /Fixt	Control Type	% Reduction	Present Hrs./yr.	Proposed Hrs./yr.	# Controls required	Measure Type	Qty	Proposed Lighting Type	Lamps /fixt	Reflect or ?	Watts /Fixt	Project Cost	Annual Savings	kWh/yr. Savings	Payback (Years)
1	Mechroom Basement	8	4' 32w T8 Elec. bal.	2	59	No Change	0%	1,000	1,000	0	Linear LED	8	4' LED T8 2200 lu. 17W	2		34	$ 192	$ 38	200	5.0
2	1908 Basement	10	4' 32w T8 Elec. bal.	2	59	No Change	0%	1,000	1,000	0	Linear LED	10	4' LED T8 2200 lu. 17W	2		34	$ 240	$ 48	250	5.0
3	Staff Room	3	36w CFL Biax Elec. bal.	2	72	No Change	0%	3,400	3,400	0	New LED Fixture	3	2x2 LED, 30W	2		60	$ 216	$ 11	122	19.5
4	Staff Room	3	26w CFL Triple Elec. bal.	2	50	No Change	0%	3,400	3,400	0	LED Relamp	3	A19 LED, 9W	2		18	$ 112	$ 29	326	3.8
5	Storage Closet	2	36w CFL Biax Elec. bal.	2	72	No Change	0%	1,000	1,000	0	New LED Fixture	2	2x2 LED, 30W	2		60	$ 144	$ 5	24	31.3
6	Children Library	34	4' 32w T8 Elec. bal.	3	89	No Change	0%	3,400	3,400	0	Linear LED	34	4' LED T8 2200 lu. 17W	3		51	$ 1,224	$ 397	4,393	3.1
7	Children Library	5	26w CFL Triple Elec. bal.	2	50	No Change	0%	3,400	3,400	0	LED Relamp	5	A19 LED, 9W	2		18	$ 186	$ 49	544	3.8
8	2002 Basement	1	U 40w T12 Elec. bal.	1	40	No Change	0%	3,400	3,400	0	LED Relamp	1	T8 U-Bend LED, 18W	1		18	$ 90	$ 7	75	13.3
9	2002 Basement	1	U 32w T8 Elec. bal.	1	31	No Change	0%	3,400	3,400	0	LED Relamp	1	T8 U-Bend LED, 18W	1		18	$ 90	$ 4	44	22.5
10	2002 Basement	1	U 32w T8 Elec. bal.	2	59	No Change	0%	3,400	3,400	0	LED Relamp	1	T8 U-Bend LED, 18W	2		36	$ 90	$ 7	78	12.7
11	2002 Basement	3	4' 32w T8 Elec. bal.	2	59	No Change	0%	3,400	3,400	0	New LED Fixture	3	4' LED T8 2200 lu. 17W	2		34	$ 432	$ 23	255	18.8
12	Hallway	22	26w CFL Triple Elec. bal.	2	50	No Change	0%	3,400	3,400	0	LED Relamp	22	A19 LED, 9W	2		18	$ 818	$ 216	2,394	3.8
13	Hallway	2	4' 32w T8 Elec. bal.	2	59	No Change	0%	3,400	3,400	0	Linear LED	2	4' LED T8 2200 lu. 17W	2		34	$ 48	$ 15	170	3.1
14	Community Room	12	36w CFL Biax Elec. bal.	2	72	No Change	0%	3,400	3,400	0	New LED Fixture	12	2x2 LED, 30W	2		60	$ 864	$ 44	490	19.5
15	Bathrooms	2	36w CFL Biax Elec. bal.	3	108	No Change	0%	3,400	3,400	0	New LED Fixture	2	2x2 LED, 30W	3		90	$ 144	$ 11	122	13.0
16	2002 Addition Upstairs	21	26w CFL Triple Elec. bal.	2	50	No Change	0%	3,400	3,400	0	LED Relamp	21	A19 LED, 9W	2		18	$ 781	$ 206	2,285	3.8
17	2002 Addition Upstairs	44	4' 32w T8 Elec. bal.	2	59	No Change	0%	3,400	3,400	0	Linear LED	44	4' LED T8 2200 lu. 17W	2		34	$ 1,056	$ 338	3,740	3.1
18	2002 Addition Upstairs	2	36w CFL Biax Elec. bal.	2	72	No Change	0%	3,400	3,400	0	New LED Fixture	2	2x2 LED, 30W	2		60	$ 144	$ 7	82	19.5
19	1970 Addition	20	26w CFL Triple Elec. bal.	2	50	No Change	0%	3,400	3,400	0	LED Relamp	20	A19 LED, 9W	2		18	$ 744	$ 197	2,176	3.8
20	1970 Addition	3	36w CFL Biax Elec. bal.	2	72	No Change	0%	3,400	3,400	0	New LED Fixture	3	2x2 LED, 30W	2		60	$ 216	$ 11	122	19.5
21	1970 Addition	8	4' 32w T8 Elec. bal.	2	59	No Change	0%	3,400	3,400	0	Linear LED	8	4' LED T8 2200 lu. 17W	2		34	$ 192	$ 61	680	3.1
22	1970 Addition	1	53 watt Incandescent	1	53	No Change	0%	3,400	3,400	0	LED Relamp	1	A19 LED, 9W	1		9	$ 34	$ 14	150	2.5
23	1970 Addition	12	26w CFL Triple Elec. bal.	2	50	No Change	0%	3,400	3,400	0	LED Relamp	12	A19 LED, 9W	2		18	$ 446	$ 118	1,306	3.8
24	1970 Addition	1	36w CFL Biax Elec. bal.	2	72	No Change	0%	3,400	3,400	0	New LED Fixture	1	2x2 LED, 30W	2		60	$ 72	$ 4	41	19.5
25	Office	4	36w CFL Biax Elec. bal.	2	72	No Change	0%	3,400	3,400	0	New LED Fixture	4	2x2 LED, 30W	2		60	$ 288	$ 15	163	19.5
26	Office	5	26w CFL Triple Elec. bal.	2	50	No Change	0%	3,400	3,400	0	LED Relamp	5	A19 LED, 9W	2		18	$ 186	$ 49	544	3.8
27	Bath	2	36w CFL Biax Elec. bal.	2	72	No Change	0%	3,400	3,400	0	New LED Fixture	2	2x2 LED, 30W	2		60	$ 144	$ 7	82	19.5
28	Flagger Room	6	36w CFL Biax Elec. bal.	2	72	No Change	0%	3,400	3,400	0	New LED Fixture	6	2x2 LED, 30W	2		60	$ 432	$ 22	245	19.5
29	Flagger Room	15	26w CFL Triple Elec. bal.	2	50	No Change	0%	3,400	3,400	0	LED Relamp	15	A19 LED, 9W	2		18	$ 558	$ 147	1,632	3.8
		253		15.5	kW existing					0		253		8.5	kW proposed					

Note: bal. = ballast, EE = energy efficient, STD = standard efficiency, mag. = magnetic, Elec. = electronic, CFL = compact fluorescent lamp

	SUMMARY OF SAVINGS BY MEASURE TYPE:		Fixture	Energy Savings		Demand				
		Measure Type	Qty.	Controls kwh/year	Efficiency kwh/year	kW Savings	Project Cost	Electric Savings	Payback (Years)	Measure Description
A	EEM-1A	Linear LED	106		9,433	3.1	$ 2,952	$ 898	3.3	Replace fluorescent lamps with LED lamps
C	EEM-1C	LED Relamp	107		11,553	3.4	$ 4,135	$ 1,044	4.0	Screw-in or Socket based LED lamps
G	EEM-1G	New LED Fixture	40		1,748	0.5	$ 3,096	$ 160	19.3	New LED fixture for surface mounting
			253	0	22,734	7.0	$ 10,183	$ 2,102		
		Gross Energy Savings		22,734	kwh					
		Net Energy Savings		**25,325**	**kwh**	**8.4**	**-422**	**gal.**	**$ 1,510**	**net**

PAYBACK PERIOD:

Estimated Cost Interior Lighting:	$ 10,183	= 6.7 year payback
Annual Energy Savings (kWh + kW):	$ 1,510	

CALCULATIONS FOR EXTERIOR LIGHTING RETROFIT

EEM-2 Millbrook Library

	Electricity	
Unit cost:	$ 0.048	/kwh
kW demand	$ 12.00	
Months of demand savings:	0	months/year

	Existing Exterior Lighting Systems					**Recommended Lighting Controls**					**Recommended Exterior Lighting Efficiency Improvements**									
Line #	Area	Qty	Present Lighting Type	Lamps /fixt	Watts /Fixt	Control Type	% Reduction	Present Hrs./yr.	Proposed Hrs./yr.	# Controls required	Measure Type	Qty	Proposed Lighting Type	Lamps /fixt	Reflect or ?	Watts /Fixt	Project Cost	Annual Savings	kWh/yr. Savings	Payback (Years)
1	Outside	9	150w HPS	1	188	No Change	0%	4,704	4,704	**0**	LED Area Light	9	LED area light, 75W	1		75	$ 1,890	$ 230	4,784	8.2
2	Outside	2	23w CFL Elec. bal.	1	25	No Change	0%	3,833	3,833	**0**	LED Relamp	2	A19 LED, 9W	1		9	$ 6	$ 6	123	1.0
3	Outside	11	A19 LED, 9W	1	9	No Change	0%	3,833	3,833	**0**	No change	11	A19 LED, 9W	1		9	$ 0	$ 0	0	
4	Outside	1	LED area light, 75W	1	75	No Change	0%	3,833	3,833	**0**	No change	1	LED area light, 75W	1		75	$ 0	$ 0	0	
		23			1.9	kW				0		23				0.9	kW			

SUMMARY OF SAVINGS BY MEASURE TYPE:

Measure Type	Fixture Qty.	Energy Savings: Controls kwh/year	Energy Savings: Efficiency kwh/year	kW Reduction	Project Cost	Annual Savings	Payback (Years)	Measure Description
LED Area Light	9		4,784	1.0	$ 1,890	$ 230	8.2	
LED Relamp	2		123	0.0	$ 6	$ 6	1.0	
	11	0	4,907	1.0	$ 1,896	$ 236	8.1	
		4,907	kwh					

PAYBACK PERIOD:

Estimated Cost Exterior Lighting: $ 1,896 = 8.1 year payback

Annual Energy Savings (kWh + kW): $ 236

CALCULATIONS TO IMPROVE TEMPERATURE CONTROL

EEM-3 Millbrook Library

INPUT DATA: 100% of Building to be Setback

		Current	Proposed	
Heating T Setpoint:	Occupied	73	73	deg. F.
	Unoccupied	60	55	deg. F.
Cooling T Setpoint:	Occupied	72	72	deg. F.
	Unoccupied	72	88	deg. F.
HVAC Schedule	Occupied	68.0	68.0	Hours per week
	Unoccupied	100.0	100.0	Hours per week
Q internal gains:	Occupied	59,808	59,808	Btuh
	Unoccupied	10,057	10,057	Btuh
Q internal gains:	Schedule	68	68	Hours per week
BLC:	Occupied	2,645	2,645	Btuh/deg. F.
(excludes DOAS)	Unoccupied	3,112	3,112	Btuh/deg. F.

Fuel Data	Heating	Cooling	
Type:	Oil - No. 2	Electricity	Economizer?
Units:	gal.	kwh	No
Unit cost:	$ 2.178	$ 0.05	
BTU/unit	138,000	3,412	
Efficiency/ COP:	80.0%	5.16	Avg. COP. EER: 17.6
		100.0%	of bldg. is cooled

CALCULATIONS:

Current		Poughkeepsie, 68 hrs./week				
Bin Mid Pt.	Occupied Hours	Unoccupied Hours	Occ Net Heat Loss BTUH	Unocc Net Heat Loss BTUH	Heating Fuel Use gal.	Cooling Energy kwh
(12.5)	0	10	166,327	215,534	20	0
(7.5)	0	21	153,103	199,976	38	0
(2.5)	3	29	139,878	184,418	52	0
2.5	20	75	126,654	168,860	138	0
7.5	26	69	113,430	153,302	123	0
12.5	53	72	100,206	137,744	138	0
17.5	65	146	86,981	122,186	213	0
22.5	92	246	73,757	106,628	299	0
27.5	132	282	60,533	91,070	305	0
32.5	166	380	47,309	75,512	331	0
37.5	211	548	34,084	59,954	363	0
42.5	295	464	20,860	44,396	242	0
47.5	352	433	7,636	28,838	137	0
52.5	237	441	(8,233)	13,280	53	111
57.5	335	580	(21,458)	0	0	409
62.5	352	547	(34,682)	0	0	694
67.5	292	478	(47,906)	0	0	795
72.5	293	257	(61,131)	(11,612)	0	1,188
77.5	266	90	(74,355)	(27,170)	0	1,263
82.5	256	44	(87,579)	(42,728)	0	1,381
87.5	90	4	(100,803)	(58,286)	0	529
92.5	8	0	(114,028)	(73,844)	0	52
97.5	0	0	(127,252)	(89,402)	0	0
102.5	0	0	(140,476)	(104,960)	0	0
	8,760	hours			2,451	6,422

Proposed		Poughkeepsie, 68 hrs./week				
Bin Mid Pt.	Occupied Hours	Unoccupied Hours	Occ Net Heat Loss BTUH	Unocc Net Heat Loss BTUH	Heating Fuel Use gal.	Cooling Energy kwh
(12.5)	0	10	166,327	199,976	18	0
(7.5)	0	21	153,103	184,418	35	0
(2.5)	3	29	139,878	168,860	48	0
2.5	20	75	126,654	153,302	127	0
7.5	26	69	113,430	137,744	113	0
12.5	53	72	100,206	122,186	128	0
17.5	65	146	86,981	106,628	192	0
22.5	92	246	73,757	91,070	264	0
27.5	132	282	60,533	75,512	265	0
32.5	166	380	47,309	59,954	277	0
37.5	211	548	34,084	44,396	286	0
42.5	295	464	20,860	28,838	177	0
47.5	352	433	7,636	13,280	76	0
52.5	237	441	(8,233)	0	0	111
57.5	335	580	(21,458)	0	0	409
62.5	352	547	(34,682)	0	0	694
67.5	292	478	(47,906)	0	0	795
72.5	293	257	(61,131)	0	0	1,018
77.5	266	90	(74,355)	0	0	1,124
82.5	256	44	(87,579)	0	0	1,275
87.5	90	4	(100,803)	(8,501)	0	518
92.5	8	0	(114,028)	(24,059)	0	52
97.5	0	0	(127,252)	(39,617)	0	0
102.5	0	0	(140,476)	(55,175)	0	0
	8,760	hours			2,007	5,995

	Present	Proposed	Savings	
Heating	2,451	2,007	444	gal.
Cooling	6,422	5,995	427	kwh
Annual Energy $			$ 988	

IMPLEMENTATION COST & PAYBACK PERIOD:

Item	Material $/unit	Labor $/unit	Quantity	Total
7-day thermostat	$ 150	$ 50	3	$ 600
				$ 0
				$ 600

Implementation Cost:	$ 600	= 0.6 year payback
Annual Energy Savings:	$988	

CALCULATIONS TO REPLACE OLD REFRIGERATORS

EEM-4 Millbrook Library

Electricity

Unit cost: $ 0.048 /kwh

INPUT DATA:

			kwh per year each			Annual kWh
Qty	cu.ft.	Type	Present	Proposed	Savings	Savings
1	15	Refrigerator w/ top freezer	581	319	262	262
				0	0	0
				0	0	0
				0	0	0
						262

CALCULATIONS:

	Annual Energy use		Annual Energy cost	
Present:	581	kwh	$ 28	
Proposed:	319	kwh	$ 15	
Annual Savings:	262	kwh	$ 13	per year

IMPLEMENTATION COST:

Cu.Ft.	Description		Qty	Material	Labor	Total
15	Refrigerator w/ top freezer		1	$ 600	$ 0	$ 600
0		0	0	$ 0	$ 0	$ 0
0		0	0	$ 0	$ 0	$ 0
0		0	0	$ 0	$ 0	$ 0
	Totals:		1			$ 600

PAYBACK:

Implementation Cost	$ 600	= 47.8 year payback
Annual Energy Savings	$ 13	

Appendix D

Assumptions/Data Used to Develop Energy and Dollar Savings Figures

Building and Occupancy Information

			Avg. # of occupants	Heating Setpoint	Cooling Setpoint		% of base electricity use resulting in internal heat gains
Floor Area:	15,000	square feet					
		days /occupied	30	73	72	days	90%
		nights/unoccupied	0	60	72	nights	80%
		# of computers	30				

Interior lighting, people and occupied levels of internal loads occur for 68 hours per week

Electricity use at night is usually 20% of the usual electricity use during day periods

(This results in an average daytime kW that is 52% of the peak metered kW)

Heating System Information

HVAC system type: Forced Air serving 100% of the building

Default Efficiencies: 0.80 COP heat 12.50 EER = 0.96 kW/ton or 3.66 COP cool

100% of building is air conditioned Does the cooling system have economizer? No

	Fuel	Efficiency			
Boiler system for water source HP or VRF systems:			Et		
Describe the **direct outside air** or **central make-up air** system:			Eff.		EER for DOAS
			cfm outside air, running		
			hours / week	0%	heat recovery efficiency

Domestic Hot Water

	Fuel	Efficiency						
DHW system energy type	Electricity							
Hot Water usage is	0.5	gallons per	person	/ day for	30	persons on	365	days/year

Weather & Schedule Information:

Select nearest weather station for bin data:	POUGHKEEPSIE				for TRM:	NYC
Base temperature for heating degree days:	65	°F. yields	6,193	HDD base65	for TRM:	Other
Base temperature for cooling degree days:	70	°F. yields	392	CDD base70	for TRM:	AC with Gas Heat

Present Schedule for Occupied/Day HVAC setpoints

Day of week		Start	End	Hours
Sun	1	8:00 AM	10:00 PM	14.0
Mon	2	10:00 AM	6:00 PM	8.0
Tue	3	8:00 AM	6:00 PM	10.0
Wed	4	10:00 AM	8:00 PM	10.0
Thu	5	8:00 AM	6:00 PM	10.0
Fri	6	10:00 AM	6:00 PM	8.0
Sat	7	8:00 AM	4:00 PM	8.0
Poughkeepsie, 68 hrs./week				68.0
				100.0

Proposed Schedule for Occupied/Day HVAC setpoints

Day of week	Start	End	Hours
1	8:00 AM	10:00 PM	14.0
2	10:00 AM	6:00 PM	8.0
3	8:00 AM	6:00 PM	10.0
4	10:00 AM	8:00 PM	10.0
5	8:00 AM	6:00 PM	10.0
6	10:00 AM	6:00 PM	8.0
7	8:00 AM	4:00 PM	8.0
Poughkeepsie, 68 hrs./week			68.0

Bin Data for Poughkeepsie, 68 hrs./week

Mid Point	Enthalpy all hours	Present Occupied Hours	Present Unoccupied Hours	Occ enthalpy	Unocc enthalpy
-12.5	-2.4	0	10		(2.4)
-7.5	-1.4	0	21		(1.4)
-2.5	0.2	3	29	0.3	0.2
2.5	1.4	20	75	1.4	1.3
7.5	2.6	26	69	2.6	2.6
12.5	3.9	53	72	3.6	4.1
17.5	5.7	65	146	5.5	5.8
22.5	7.4	92	246	7.0	7.5
27.5	9.0	132	282	8.5	9.3
32.5	10.8	166	380	10.5	10.9
37.5	12.9	211	548	12.4	13.1
42.5	15.1	295	464	14.4	15.5
47.5	17.2	352	433	16.4	17.8
52.5	19.6	237	441	18.3	20.3
57.5	22.2	335	580	21.1	22.9
62.5	25.3	352	547	23.7	26.3
67.5	28.5	292	478	26.5	29.8
72.5	31.2	293	257	30.0	32.6
77.5	32.3	266	90	31.8	33.9
82.5	35.2	256	44	35.0	36.2
87.5	37.3	90	4	37.3	35.6
92.5	35.9	8	0	35.9	
97.5	0.0	0	0		
102.5	0.0	0	0		
		3,544	5,216		

ESTIMATE OF BUILDING LOAD COEFFICIENT & TRUE-UP TO BILLED ENERGY USE

Millbrook Library
3 Friendly Lane
Millbrook, NY, 12545

Building Information

Width (typical)	122	feet	Building Floor Area	15,000	sq. ft.
Equivalent Length	122	feet	Roof Area	16,250	sq. ft.
Number of Floors	1.0	floors	Gross Wall Area	4,409	sq. ft.
Avg. Floor to Floor Height	9	feet per floor	Building Volume	135,000	cubic feet
Roof or Ceiling rise is	5	feet in 12' run			

Estimate of Conductive Heat Loss

Surface			Area	R-value	U Factor	U x A Btuh/deg. F.	% of BLC w/o ventilation
Roof	n/a		16,250	26.1	0.038	623	24%
Walls	88.1%	of GWA	3,885	22.8	0.044	171	6%
Glazing 1	10.0%	of GWA	440	1.7	0.588	259	10%
Glazing 2	0.0%	of GWA	0	0.9	1.111	0	0%
Doors 1	4	3x7 doors	84	2.0	0.500	42	2%
Doors 2	0	3x7 doors	0	1.7	0.588	0	0%
	Total Exterior Surface Area		20,659	sq.ft.		1,095	41%

		ACH	equiv. cfm	Btuh/deg. F.	BLC (without ventilation)	
Est. Infiltration Rate	Occupied	0.83	1,868	2,017	2,645	Btuh/deg. F. Occupied
Est. Infiltration Rate	Unoccupied	0.83	1,868	2,017	3,112	Btuh/deg. F. Unoccupied

		cfm	Fraction	Btuh/deg. F.	**Total BLC with Ventilation**	
Est. Ventilation Rate	Occupied		100%	0	**2,645**	**Btuh/deg. F. Occupied**
Est. Ventilation Rate	Unoccupied		100%	0	**3,112**	**Btuh/deg. F. Unoccupied**

Heat Gain Estimation

Estimated Solar Gain: 15% of building heat loss during occupied periods will be met by solar gains

		kW	# People	Total BTUH	Hours/wk.
Loads & People	Occupied	15.4	30	59,808	68.0
	Unoccupied	2.9	0	10,057	100.0

Heat Loss Study - continued

Millbrook Library
3 Friendly Lane
Millbrook, NY, 12545

		Current	
Heating T Setpoint:	Occupied	73	deg. F.
	Unoccupied	60	deg. F.
Cooling T Setpoint:	Occupied	72	deg. F.
	Unoccupied	72	deg. F.
HVAC Schedule	Occupied	68	Hrs. per week
	Unoccupied	100	Hrs. per week
Q internal gains:	Occupied	59,808	Btuh
	Unoccupied	10,057	Btuh
Q internal gains:	Schedule	68	Hrs. per week
BLC:	Occupied	2,645	Btuh/deg. F.
	Unoccupied	3,112	Btuh/deg. F.

Fuel Data	Heating	Cooling	
Type:	Oil - No. 2	Electricity	Economizer?
Units:	gal.	kwh	No
Unit cost:	$ 2.178	$ 0.05	
BTU/unit	138,000	3,412	
Nom. Eff, COP	0.800	3.66	COP
Avg. Eff, COP	0.800	5.16	Avg. COP
		12.5	EER
		100%	of bldg. cooled

DOAS Energy Use	
0	cfm
0%	heat recov. Eff.
Heating 0	
0	
0%	eff.
0.00	COP cool
0	hrs/week

Current Poughkeepsie, 68 hrs./week

Bin Mid Pt.	Occupied Hours	Unoccupied Hours	Occ Net Heat Loss BTUH	Unocc Net Heat Loss BTUH	Heating Fuel Use gal.	Cooling Energy kwh	DOAS Hours	DOAS Heating kBtu/yr.
(12.5)	0	10	166,327	215,534	20	0	0	0
(7.5)	0	21	153,103	199,976	38	0	0	0
(2.5)	3	29	139,878	184,418	52	0	0	0
2.5	20	75	126,654	168,860	138	0	0	0
7.5	26	69	113,430	153,302	123	0	0	0
12.5	53	72	100,206	137,744	138	0	0	0
17.5	65	146	86,981	122,186	213	0	0	0
22.5	92	246	73,757	106,628	299	0	0	0
27.5	132	282	60,533	91,070	305	0	0	0
32.5	166	380	47,309	75,512	331	0	0	0
37.5	211	548	34,084	59,954	363	0	0	0
42.5	295	464	20,860	44,396	242	0	0	0
47.5	352	433	7,636	28,838	137	0	0	0
52.5	237	441	(8,233)	13,280	53	111	0	0
57.5	335	580	(21,458)	0	0	409	0	0
62.5	352	547	(34,682)	0	0	694	0	0
67.5	292	478	(47,906)	0	0	795	0	0
72.5	293	257	(61,131)	(11,612)	0	1,188	0	0
77.5	266	90	(74,355)	(27,170)	0	1,263	0	0
82.5	256	44	(87,579)	(42,728)	0	1,381	0	0
87.5	90	4	(100,803)	(58,286)	0	529	0	0
92.5	8	0	(114,028)	(73,844)	0	52	0	0
97.5	0	0	(127,252)	(89,402)	0	0	0	0
102.5	0	0	(140,476)	(104,960)	0	0	0	0
	8,760	hours			2,451	6,422	DOAS fuel use	0
							DOAS cool use	0

Cross Check Against Historic Consumption

	Historic		Calculated	Difference	
Present Annual Heating Fuel Use is	337	mmBTU	338	100%	of present fuel use